

CM15: PUBLIC GOODS (4/21/20)

MOST, BUT NOT ALL, OF WHAT YOU SHOULD KNOW

1. What are the two criteria that economists use to define a public good?
2. What is the meaning of the term rivalrous?
3. What is the meaning of the term excludable?
4. Why are most goods that have public in their titles are not public goods in the economist's usage?
5. Are there only private and public goods?
6. What is the five-way classification (taxonomy) of goods used in the Commentary?
7. Why will public goods either not be provided by the market at all, or provided at less than the optimal level?
8. What is the optimal level of provision of a public good?
9. What is a property right?
10. Why do property rights provide incentives to preserve scarce resources?
11. Why is the Problem of the Commons *not* about common property?
12. What is the difference between common property rights and open access systems?
13. Why is climate change a global public good problem?
14. Would climate change be associated with free riding?
15. What problems arise when trying to evaluate climate change policies that involve costs and benefits spread over time?
16. Would climate change taxes be regressive?
17. In what sense do international climate change policies involve issues of fairness?

1. PUBLIC GOODS AND SERVICES.

1. By now you are aware that economics, like any other academic discipline, uses a specialized vocabulary (jargon) and that economists sometimes use a common English word in a specific and non-standard way. When answering questions about "public" goods and services on the tests you must *always answer the questions using the economists' definition of "public"*.

To be a *"public good"*, a good or a service must satisfy **two** criteria: (1) it must be *non-rival*; and (2) it must be *non-excludable*.

2. RIVAL VERSUS NON-RIVAL GOODS.

1. If a good or service can be used or utilized or consumed by only one person, or only one person at a time, it is called a *rival good or service*, for example, a pair of pants or a haircut or a hamburger or a seat in the lecture hall or a parking space. Most goods and services are effectively rival goods: although we can share a slice of pie and, even better, a shower, we do not usually do so.

Some goods and services are consumed jointly, by more than one person at a time, e.g. national defense, law and order, the internet, a smoothly functioning financial system: these *goods and services that we consume jointly are called non-rival*. More than one person, even hundreds of millions of people, can consume a public good or service at the same time.

2. The crucial issue is: *Does my use of the good or service mean that you cannot consume it*. For example, we all consume the same amount of national defense at the same time – even those anti-war protestors outside of the Federal building – and the fact that I am protected does not reduce the amount of defense available and consumed by them, and vice versa. (Therefore, *the marginal cost of defending me, or you, is effectively zero.*)

Whether a good or service is rival or non-rival may not be an inherent property of the good or service but only of its time or place of use. If I drive my car onto I-5 during the rush hour then you will have to slow down because I have added to the congestion – and I do not pay any attention to the fact that I have imposed an external cost on you. My driving onto the congested interstate during rush

hour adds to the costs of its users.¹ But notice that when I drive my car onto I-5 at 4 a.m. I do not cause a cost to other drivers because I-5 is not congested at that time of night and I-5 is then essentially non-rival.

3. EXCLUDABLE VERSUS NON-EXCLUDABLE GOODS.

1. *A good or service is excludable if its use could, in principle, be limited by the producer*; the fact that an excludable good or service is provided to everyone without charge, PBS, is *not* relevant because PBS *could* scramble its signal, in the way that cable television companies do. *Excludability is about the technical possibility of exclusion from consumption, not the about the practice of its provision.* Most goods or services are excludable to some extent – building a wall (topped by electrified razor wire and surrounded by land mines and an alligator filled moat and patrolled by starving attack dogs) around a National Park will exclude non-paying potential users. Of course, it has to be a serious barrier, the President’s border wall does not seem to be an effective means of excluding potential migrants.

2. *A good or service is non-excludable if it is impossible for its producers to stop consumers from consuming the good or service.* Because the producers cannot stop you from consuming their good or service, they cannot charge you for its use. Public parks are **not** public goods, because you can fence them and charge admission, which is what Disney would do if it owned Yosemite; public education is **not** a public good because WWU can exclude you if you don't pay your fees; Public Television is **not** a public service/good because PBS *could* scramble its signal and charge you to watch its programs.

4. PUBLIC vs PRIVATE GOODS

1. *The word "public" is not the defining characteristic of a public good or service*: the good or service must be *both non-rival and non-excludable* before it meets the economist's criteria for being called a public good.

WWU is a “public” university, but because entrance can be restricted to those who meet certain scholastic qualifications and can pay the fees, WWU is *not* an example of a public good.

A similar argument applies to “public” education as a whole; because there are private schools, education must be an excludable service, and so public education does not meet the criteria for a public good.

¹ The relationship between public goods and externalities is interesting, but not something that we will pursue.

Defense is the classic example of a *public good* because it is both non-rival and, effectively, non-excludable.

The *warning signal* that used to be on a water tower by WWU was a public good because it was non-rival (the fact that I could hear the signal did not diminish the amount of signal that you could hear), and non-excludable (because once the signal went off anyone within hearing range could hear it and there was no way in which any individual could be stopped from hearing the signal).

WWU's fire alarm system is a public good.

Street lighting is effectively non-rival and non-excludable.

Lighthouses are both non-rival and non-excludable because any ship within sight of the lighthouse sees the same amount of signal irrespective of the number of ships within range of the beam, and once the light is lit, any ship can see the light. Lighthouses are therefore public goods. The English economist and Nobel prize winner Ronald Coase pointed out that in England during the 19th century lighthouses were sometimes privately funded for profit, but that was because a fee, to pay for the building and maintenance of the lighthouse, was levied on ships using the nearby harbor, those ships which did not use the harbor could not be charged the fee and therefore used the lighthouse for free.

5. A PUBLIC GOOD TAXONOMY.

1. In the 18th century insurance companies provided firefighting in England – you can still see the plaques (shields or “marks”) on buildings today: “the fire-mark was invented for the purpose of and used as a guide to the brigade. The shareholders of the first fire office, started, remember, for the purposes of business with the object of making a profit, would not have been such philanthropic idiots as to keep up an expensive brigade to extinguish fires on anyone's property. No, this brigade was formed for two reasons; firstly, as an inducement to people to insure because of its protection and secondly, to enable the company to save as much property as possible, and thus reduce the losses. If, in the event of a fire, a brigade arriving on the scene found it was not their office that insured the risk, and that no surrounding property in which they were interested seemed to be in danger, they went home again, perhaps to bed, and left the fire to be fought either by the brigade belonging to the insuring company or by the public if no insurance existed”. Clearly there were problems with such a system and the fire service is now provided as a public, often volunteer, service. Firefighting is, in principle, excludable and, to some extent, it is rival. The private vs public dichotomy is not watertight.

2. We can think of goods and services as lying along a spectrum with “pure” private goods and services at one end and “pure” public goods and services at the other end. Where a good or service lies along the line depends on how much of the two characteristics (rival/excludable) it embodies. We can roughly divide goods and services into five groups:

- 1) Rival and excludable: [pure private goods](#) and services: ice cream.
- 2) Rival but semi-excludable: [common property resources](#): Alpine meadows, English “Commons”.
- 3) Rival and non-excludable: [open access](#) systems, where there are no property rights, such as ocean fisheries.
- 4) Non-rival but excludable: these goods and services are often called [quasi-public goods](#) because they share important features with public goods and services: cable TV. Public television chooses not to exclude viewers but it could scramble its signal as HBO does. It is the possibility of exclusion that is important not whether people are excluded.
- 5) Non-rival and non-excludable: [public goods](#) and services: defense, public warning systems.

3. There is a tendency to emphasize the non-excludability feature of public goods because the non-excludability of public goods is easier to understand than the non-rival feature of public goods. However, economists are also interested in non-rivalry because if a good or service is non-rival then it is not economically efficient to charge for it; essentially adding users has little or no marginal cost and so the efficient price, where $MSC=MSB$, is zero. (See Figure 2 – I cut Figure 1.)

But although the MSC may be zero the average cost of the good or service will usually be positive and the firm will not be viable if it gives its product away: although your transit ride at 9.20 pm may add almost nothing to the costs of the WTA, the transit system must raise enough money from its fares to pay for the buses and personnel and other costs of running the bus service.

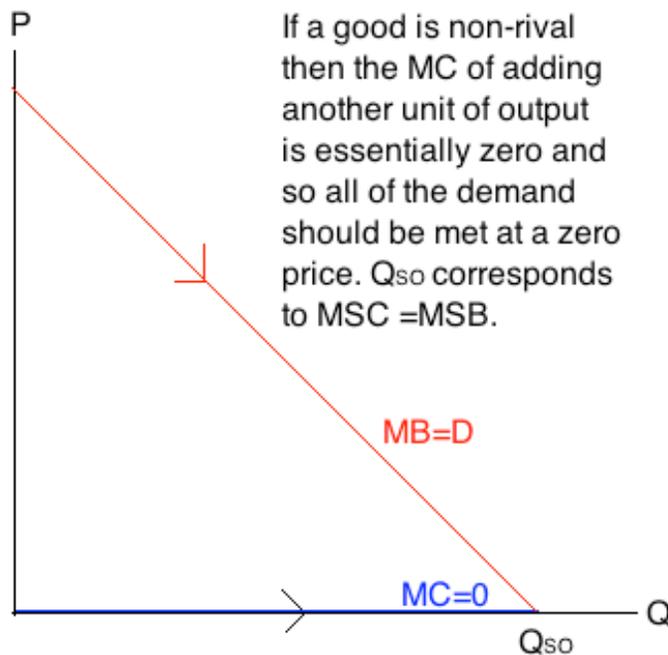


Figure 2

6. UNDER-PROVISION OF PUBLIC GOODS.

1. If the producer cannot exclude users from consuming a public good or service once it has been provided, then why would anyone pay for it, except out of conscience or civic virtue? If the provider cannot charge for the good or service, then the market will either not produce it at all (defense), or will under-provide the service (public television). Only about 10% of KVOS viewers contribute to its costs – even people who watch three hours a night seven days a week.

2. In ancient Greece and the early years of the Roman republic citizens were expected to provide defense for the city-state, but that was a period in which a shield, spear, sword and armor were within the purchasing power of the “average” citizen – these were slave owning societies. Today external defense is beyond the resources of an individual, or groups of individuals. (There are private security firms and gated communities that can provide protection, but only to a limited extent – ultimately when things get out of hand you call in the police, or even the National Guard.) Mercenaries were important in 14th and 15th centuries in Europe, and are important in some parts of Africa today, but the nation state has to establish a monopoly on the use of force within its

borders. The United States has increasingly used US citizens as “mercenaries” in Iraq and Afghanistan, but these armed guards provide protection for installations, convoys, and individuals and do not engage in combat as such. When the fighting gets tough it’s the “poor bloody infantry” that goes in and sorts the situation out. (The US also uses local “militias” to do some of the fighting.) No one expects private firms to provide B-52 airstrikes.

3. We have security services and gated communities, but society has decided that public provision of law and order is superior to private provision. The government has a monopoly in the use of force against its citizens, and a sign that a state has failed is that it has lost its monopoly on force. Mexico seems to have lost its ability to control the cartels, but ultimately the Mexican President could use the armed forces to defeat the cartels, but only if they were stupid enough to come out and fight.<https://www.businessinsider.com/el-chapos-son-led-dramatic-rescue-of-his-half-brother-in-mexico-battle-2019-10>

4. *If the government is to provide public goods then the government will have to pay for them. This money comes from taxation.* How much of the public good should be provided requires a careful cost-benefit analysis. *Since everyone consumes exactly the same amount of the public good or service the individual marginal benefit curves (demand curves) have to be summed **vertically** to determine the market demand for the public good.*

We are not calculating the quantity demanded of the good or service given its price. The market demand curve for a public good or service reflects the *collective* benefit obtained from consuming each unit of the public good or service; the sums of the marginal benefits received by each citizen protected by our defense (see Figure 3.) In my example Adam and Eve have preferences about the number of extremely expensive carrier groups that should be maintained as part of the US navy. (Currently the US navy has eleven carrier groups, consisting of an aircraft carrier, at least one anti-missile cruiser, at least two anti-submarine/anti-surface missile destroyers, and, perhaps, two more destroyers or frigates, and often a nuclear attack submarine, plus a supply ship and as many as ten other support ships. Although some other nations have aircraft carriers and even carrier groups none of them have the strike capabilities of a US carrier group.)² The marginal benefit of carrier groups for Adam and Eve

² Forming a large, and very expensive, target for a relatively inexpensive shore-based nuclear missile.

are shown in the diagram – I am deliberately vague about how the MBs and MCs are measured. According to my example the optimal number of carrier groups is 4; that number of carrier groups yields MSBs equal to MSCs.

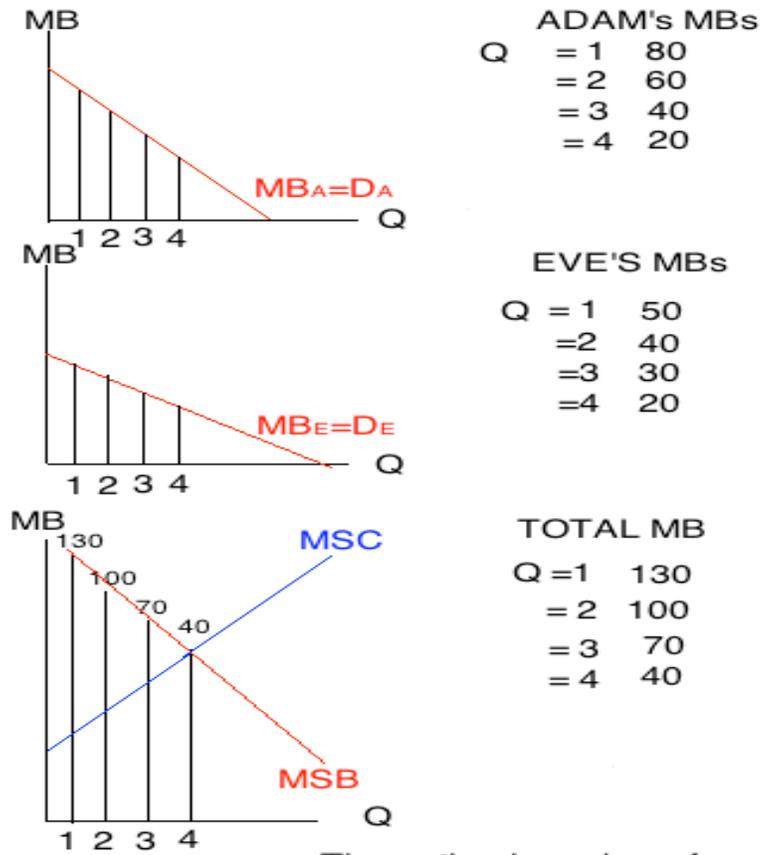


Figure 3

The optimal number of carrier groups is 4; where the vertical sum of Adam and Eve's MBs, the MSB (=D) is just equal to the height of the MSC curve for producing carrier groups, that is, MSB=MSC.

6. FREE RIDERS

If a good or service is non-excludable then there will be problems of "free riding" – *self-interest would argue that it is better to let everyone else go on the posse and reduce rustling, while you stay at home and fix your fences.* But that argument applies to everyone else too, and so the posse is too small or does not get formed at all.

7. PROPERTY RIGHTS.

1. *A property right is the term economists use to refer to the ownership of something, usually some form of asset; capitalism is predicated on the existence of property rights.* Property rights confer on the owner the right to sell or lease the asset, to transform it in a variety of ways, such as keeping it in good or bad repair, and usually the property right entitles the owner to exclusive use of the asset. If you own a Picasso then you have the right to break it into firewood and burn it, although only in ways that do not endanger my property rights by, for example, causing my house to burn down. You may not dump your waste in my dumpster, and certainly not in my backyard – you may burn down your house but not if, as is common in England, it is attached to mine. *Governments provide public goods, legal systems and courts, to settle disputes over property rights.* The government also provides police, and courts, and prisons, to protect property rights (including our persons and lives). Property rights are a vital component of civil society and are one of the foundation stones of a well working economy. A major factor that inhibits the growth of LDCs and transition economies is the absence of the Rule of Law³ and the tenuous state of property rights. If you cannot establish your legal claim to the family farm that your ancestors have farmed for generations, then you cannot use it as security for a loan.

2. If an asset, such as a natural resource, is not excludable then, even if someone owns it, it takes on some of the attributes of a public good. Deer have no concept of property rights and eat my wife's flowers. If your cattle eat my wife's flowers then I may sue you for damages, but I cannot shoot your cows because they are your property, although I may shoot the deer, if the law does not protect them.

3. *If I have property rights in an asset and can enforce them, then I have an incentive to carefully manage the asset* because I either receive benefits from my using it, or, I can sell or lease it to someone else who would like to use the asset. If I do not have secure property rights in the asset then I do not have

³ The requirement that everyone, including Presidents and members of the government or the ruling party, is subject to the law and must receive equal treatment under the law.

incentives to improve or even maintain it. Economists believe that a partial solution to the poaching of some endangered species – for example, African elephants – is to establish property rights to them for the local community.

4. In the eighteenth and nineteenth centuries Scottish chieftains often cleared their tenants, who paid low rents, from their low productivity small farms (crofts) in order to grow crops such as turnips and specially to use the land to graze sheep. The crofters had no property rights even though the crofts may have been farmed by the same family for generations. The law regarded the clan chiefs as the hereditary owners of the clan lands. Many Scots migrated to Canada and the US during these years.

7. THE “TRAGEDY” OF THE “COMMONS”.

1. In 1968⁴, at the point at which “environmentalism” was becoming a major issue in the US (allied with the Civil Rights and anti-Vietnam war movements) an ecologist, Garret Hardin, published what was to become one of the most cited papers in *Science*, “The Tragedy of the Commons”. The paper became an instant classic although Hardin admitted that the point that he was making was banal. Hardin’s paper was about population growth, but it was his remarks on property rights and how they affect resource use that grabbed people’s attention.

2. When discussing property rights systems, it is important to distinguish between different types of property rights systems and to be careful not to confuse different systems that have very different effects on how resources are

⁴ This is *not* something you need to know for the tests. 1968 was also the year in which Paul Ehrlich published “The Population Bomb”, which went on to sell two million copies. In his book Ehrlich argued that hundreds of millions of people would die from starvation during the 1970s and 1980s as world population outstripped world food production. In 1968 the world’s population was about 3.5 billion people, today it is about 7.4 billion and it will probably peak, according to UN demographic forecasts, at around 10 billion, although some forecasters predict that the world population will peak around 2055 at about 8.5 billion. Ehrlich continued to bring out new editions of his book, carefully changing his forecast. In 1980 Julian Simon made a famous bet with Ehrlich: Simon let Ehrlich choose any five commodities – Ehrlich chose copper, chromium, nickel, tin, and tungsten – and bet him \$1,000 that the real prices of the commodities would decline by 1990. The prices of all five metals fell in real terms and so Ehrlich lost, although he was probably unlucky in his choice of decade.

used. I will distinguish between *private property systems*, *common property systems* (in which the asset is rival but is excludable for those who are not part of the "common ownership" system), and *open access systems* (in which the asset is rival but non-excludable).⁵ Hardin, as he later admitted, confused common property systems with open access.

Hardin originally argued that common property systems lead to over use of natural resources, to the point at which they become completely exhausted. *Because the resource is not private property (no one person owns it) no one has any incentive to use the resource in a sustainable fashion.* There is a Prisoners' Dilemma, because everyone knows that overuse is self-defeating, but everyone has an incentive to maximize their short term use of the resource, while that asset is still productive, because reducing your use will only save the asset if everyone reduces their use, but everyone is thinking in the same way and chooses to maximize short-term gain and sacrifice long term sustainability.

3. The title of the Hardin's original paper refers to what in England are called "Commons" – communal (common property) grazing lands. The commons had existed for hundreds of years until the "enclosure movement" (which began in the sixteenth century) when rich landlords dispossessed the peasants who had grazed their cattle on the commons because the peasants did not have title to (ownership of, or property rights to) the land. (Similar seizures have occurred in China in recent years.) The irony was that the commons had existed for hundreds of years because they had *not* been overgrazed. Instead the local community managed the land communally, carefully restricting access to it. Swiss alpine meadows have been grazed communally for hundreds of years; they are owned and managed by the local Commune.

4. *So long as property rights exist and are transferable there is an incentive to conserve them. But "open access" systems, where no one owns the resource, are likely to be used to exhaustion* – if you take my cattle then you are rustling, but if you take fish from international waters then the more you take the more profit you make in the short run. Ocean fisheries are the best example of the "Open Access" dilemma: if everyone takes a sustainable number of fish then there will be fish in perpetuity, but everyone has an incentive to take a more

⁵ Elinor Ostrom, a political scientist by training, was awarded the economic Nobel Prize for her research on the many ways property rights are assigned.

than the sustainable amount. Everyone understands this, but if there are no property rights, and no effective way to enforce agreements, then there is no way to stop rational over fishing. Currently ocean fisheries are the most rapidly depleting natural resources in the world. However, some local fisheries have been managed successfully.

8. GLOBAL PUBLIC GOODS and CLIMATE CHANGE.

1. There are many environmental issues that are *transnational*; where the pollution crosses national boundaries. Acid rain is “exported” by tall smoke stacks and prevailing winds from power plants in the mid-west to the north-east of the US and to eastern Canada, and from power plants in the UK to Scandinavia and Germany. Ozone depletion was a worldwide problem, not just something generated by a particular country.

2. Climate change is a global public goods problem, something that affects the whole world and causes harm to future generations as well as current ones. Policies designed to reduce climate change are like public goods and will be subject to the usual free rider problems: why should we bother to deal with climate change when other countries are working on the problem and we benefit freely from their expenditures? Whoever pays for the reduction in greenhouse gases generates a benefit to everyone in the world who would be adversely affected by climate change. The climate change expenditures are not excludable and are non-rival.

3. One approach to climate change is to introduce “revenue neutral” carbon taxes, taxes on all types of carbon dioxide producing activities. (Taxes are *revenue neutral* if their revenues are used to offset other taxes). A *carbon tax is a tax on all types of carbon emissions*. A carbon tax is more efficient than an increase in the gasoline tax because all sources of carbon dioxide should be treated on an equal footing in order to achieve optimal abatement: the last dollar spent on any type of CO₂ source should give the same amount of greenhouse gas reduction. Indeed, all forms of greenhouse emissions, including farmers who raise methane emitting cattle and sheep should be taxed if the policy is to be efficient.

4. Climate change policies involve costs and benefits that occur at different points in time. An interesting issue is *how to discount the future streams of costs and benefits associated with different climate-change policies*. If the

discount rate is set very low, as it was by Nick Stern when he put together “The Stern Review on the Economics of Climate Change” (2006), then policies that have large current costs, but benefits spread over a long period of time would be optimal; the sum of the undiscounted benefits would be large relative to the current costs. But if, as most US reviewers of the report believed, the discount rate should be in line with current interest rates then policies that take a more gradual approach, that spread out the costs over longer periods, would be favored – we should act later rather than now.

If we put off dealing with the problem and save \$10b this year then, in 72 years at a 4% rate of return we will have \$160b to spend on the problem. If the rate of discount is 10% then we will accumulate \$320 over the same period. If the discount rate is 1% then we accumulate only \$20b. If the discount rate used is 0.1% (one tenth of one percent) – the rate Stern used – then the \$10b accumulates to about \$11b. In the last decade interest rates have been very low and so this might have been a good time to start dealing with climate change.⁶

5. Climate change policies involve *inter-generational transfers*. If we deal with climate change now then we benefit future generations – who if the historical trend continues will probably be richer than we are, which means *transferring income from the poor to the rich*.

6. Climate change policies involve difficult issues such as *fairness*. Why should LDCs pay for climate change that was initially started in developed countries? How should the burdens of climate change policies be shared amongst rich and poor countries? Why should future generations have to clean up after their ancestors?

7. My *personal* opinion – for what it is worth since I am not an expert in this field – is that we are going to have to adapt⁷ to climate change or encourage a

⁶ The Federal Reserve Fund rate was about one quarter of one percent for much of this period, which, in years in which inflation was larger than one quarter of one percent, meant that real interest rates were negative. In early 2019 the Federal Funds rate is about 2.15%, currently it is 0%.

⁷ Humans adapted to the great Ice Ages. However, that adaptation was before we had invented cities and agriculture – imagine Seattle covered by three miles of ice as it was in the last ice age. In CM20 I argue that humans adapt to adverse changes in their life circumstances surprisingly quickly.

massive technological investment in *carbon sequestration* – removing carbon from the atmosphere and storing it or using it in some way that does not allow it to seep back into the atmosphere.⁸ One way to encourage research and development into carbon sequestration would be to offer a massive prize (say \$100b) to anyone who can come up with a *commercially viable* and easily *scalable* process to remove carbon from the atmosphere – like the British Admiralty’s prize for a very accurate chronometer that would enable sailors to determine their longitude accurately.

We should always remember that positive incentives are more effective than negative ones. Policies that harness the self-interest of households and firms are likely to be more effective than penalties, and market type solutions are likely to perform better than command and control approaches. Also remember that

My dismal prognostication about current climate change policy is based on a number of factors: (1) Halting or slowing carbon emissions does not address the problem that we already have excessive carbon concentration in the atmosphere; (2) We are currently moving into a period, that may be short lived, in which carbon fuels are becoming cheaper, not more expensive; (3) It is very difficult to get voters interested in policies that have an obvious immediate cost (higher taxes on carbon emissions) and uncertain and far future benefits (climate scientists think in terms of 85-year time horizons, whereas voters and politicians think in terms of next year or at most four years ahead). However, recent work by climate scientists suggests that the time available to deal with climate change may be only twenty years; (4) The scientific debate is over the heads of, and supremely boring to, most people. The average citizen has difficulty understanding or caring about the difference between local weather conditions and global climate – the hottest recorded global temperatures have all occurred in this century, but what interest is that to someone who is digging themselves out of snow in New York? (Climate scientists made a serious tactical error when they spent so many years talking about global “warming” rather than climate change.) (5) There are powerful economic groups, such as the US coal, oil, and energy lobbies that have an interest in obfuscating the scientific debate. (4,660)

⁸ Planting trees is a way to sequester carbon.

Some links if you have the time and interest:

The *first* link has a very nice discussion of public goods written for British high school students.

<http://tutor2u.net/economics/revision-notes/a2-micro-public-goods.html>

The *second* link is about the idea of global public goods.

<http://mondediplo.com/2000/06/15publicgood>

You need only read the section in the *third* link on "The Tragedy of the Commons".

<http://www.thelandmagazine.org.uk/articles/short-history-enclosure-britain>

The *fourth* link is an obituary of Elinor Ostrom, it shows what a very parochial group economists are; our only saving grace in this case was that her work was finally recognized by the Nobel prize in economics.

http://www.nytimes.com/2012/06/13/business/elinor-ostrom-winner-of-nobel-in-economics-dies-at-78.html?_r=0

The *fifth* link is about recent US policy designed to manage our fisheries.

http://www.washingtonpost.com/national/health-science/us-tightens-fishing-policy-setting-2012-catch-limits-for-all-managed-species/2011/12/30/gIQAALLObjP_story.html

The *sixth* link is about the debate about climate change science.

<http://grist.org/series/skeptics/>

The *seventh* link is about the Copenhagen Consensus, a study done by a group of distinguished economists who tried to determine what were the most pressing problems facing the world. Climate change was ranked as a low priority.

http://en.wikipedia.org/wiki/Copenhagen_Consensus

The *eighth* link is a review by Hal Varian, a very distinguished economist who is now the chief economist for Google, of two reviews of the Stern Report. The piece is about how the discount rate affects the numbers.

http://www.nytimes.com/2006/12/14/business/14scene.html?_r=0

The *ninth* link is about carbon markets.

<http://dotearth.blogs.nytimes.com/2009/06/05/how-carbon-markets-can-make-both-economic-and-ecological-sense/>

The *tenth* link is a recent look at the issues including a suggestion for a billion dollar prize for carbon sequestration (great minds think alike).

<http://www.bloombergvew.com/articles/2014-02-24/emissions-a-cool-assessment-of-a-hot-button-issue>

The *eleventh*, and last link, is about a proposal for an ad campaign on climate change. Some businesses, for example the insurance industry are beginning to show a lot of interest in how climate change might affect their profitability.

<http://www.nytimes.com/2014/02/18/us/politics/financier-plans-big-ad-campaign-on-environment.html>